REMARKS

Claims 1-4, 12 and 13 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Hansen et al (US 5,589,256).

Claims 1, 5-11 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Hansen et al (US 5,589,256) as applied to Claims 1-4, 12 and 13 and further in view of Hansen et al (US 5,789,326).

Amendments to the Claims

Claim 1 has been amended to indicate that curing occurs at a temperature from about 160 °C to about 215 °C thus further distinguishing from the Hansen et al. reference which teaches binding under conditions that favor formation of hydrogen bonds or coordinate covalent bonds. Specifically, the hydrogen bonds or coordinate covalent bonds are formed below 145°C, below 100°C and even at room temperature, column 22 line 63 to line 65. Claims 15-17 have been added to further limit the curing temperature.

The Rejection of Claims 1-4 and 12 -14 Under 35 U.S.C. § 103 (a)

Claims 1-4 and 13 and 14 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Hansen et al., US 5,589,256, (the '256 patent). Withdrawal of the rejection is respectfully requested for the following reasons.

There is no motivation or suggestion in the Hansen et al. invention to arrive at the instant invention. Hansen et al. teach away from forming covalent bonds such as in the instant invention.

Hansen et al. teach binding of particles to cellulose fibers through hydrogen bonding and coordinate covalent bonding and achieve the objective of the invention by providing fibers with hydrogen bonding functional sites and applying, to the fibers, a binder. The binder has a functional group that forms a hydrogen bond with the fibers and a functional group that is capable of forming a hydrogen bond or coordinate covalent

bond with particles that have a hydrogen bonding or coordinate covalent bonding functionality, column 2, lines 57-64.

Hansen et al. state that their invention can be used with fibers *that have substantial intrafiber covalent crosslinks* or with fibers which are substantially free of intrafiber covalent crosslinking, column 22, line 7-10. Ease of densification is associated with the hydrogen bonds and coordinate covalent bonds formed between the binder and the particle and may be applied to the fibers before, subsequent, or simultaneously with the addition of particles, column 22, lines 30- 39. Hansen et al. state that binding is performed under conditions that favor formation of hydrogen bonds or coordinate covalent bonds and *discourage formation of covalent bonds,* column 22, line 44 - 46. These hydrogen and coordinate covalent bonds can form below 145°C to room temperature, and can bind particles to fibers under neutral to alkaline conditions, column 22, line 64-65. In contrast, conditions that favor covalent bond formation require elevated temperatures above 145°C and acidic conditions, column 22, line 59 - 61.

The Examiner has stated that the Hansen et al. patent sets forth the use of binders being applied to the fibers wherein the binders may be selected from a combination of a polycarboxylic acid and a polyol, column 19, line 61 and then states that it is well known that crosslinking agents such as polycarboxylic acids form covalent bonds with individualized cellulose fibers. Applicants submit that the combination of the crosslinking agent and the polyol is in the context of the two agents being used as binders, rather than as crosslinking agents. From column 13, line 10 to column15, line 39, Hansen et al. discuss characteristics of polymeric binders and from column 15, line 41 to column 20, line 61, characteristics of non polymeric binders are discussed. Subsequently Hansen et al. discuss the process advantages of the invention including binding particles to fibers without the application of heat and even at ambient temperature. Hansen et al. expressly state their invention is distinct from crosslinking processes in which elevated temperatures are required to covalently crosslink cellulose groups, column 20, line 65 to column 21, line 5.

Hansen et al. state that fibers that have high bulk from intrafiber crosslinks are prepared by individualizing the fibers and curing them at an elevated temperature (above 150°C.). Hansen et al. then state that application of the binder on such high bulk fibers

preferably occurs *after* the curing step, particularly if the binder is capable of functioning as a crosslinking material. Hansen et al. state that specific binders that can crosslink are polyols, polycarboxylic acids, and polyamines, column 23, line 1- 7.

Applicants have not studied polyamines as binders that can crosslink. Applicants have shown that, in the case of polyols, this is not true. The Examiner is requested to review the Declaration of Mr. Angel Stoyanov. Mr. Stoyanov states that an increase in FAQ wet bulk, relative to an untreated control, reflects that fibers have been crosslinked. As evidence, the Examiner is requested to review Table 1 of the Stoyanov Declaration. Here it is clearly shown that pulp alone, Sample A, has a FAQ wet bulk of 11.59 and Whiteness Index, $WI_{(CDM-L)}$, of 78.16. When pulp is treated with 2 % by dry weight sodium hypophosphite, FAQ wet bulk is 12.26 cc/g and $WI_{(CDM-L)}$ is 77.87. When pulp is treated with citric acid and sodium hypophosphite, Sample C, the FAQ wet bulk is increased to 18.48 cc/g and the $WI_{(CDM-L)}$, is 68.69. When pulp is treated with citric acid, sodium hypophosphite and sorbitol, a polyol, at the 2 and 6 percent by weight level of sorbitol on pulp, Samples D and E, respectively, FAQ wet bulk is 18.29 and 17.05 cc/g, respectively, essentially the same as with sodium hypophosphite and citric acid alone. The $WI_{(CDM-L)}$, of Samples D and E, is increased to 78.71 and 81.30, respectively. However, when pulp is treated only with sodium hypophosphite and two different levels of sorbitol, 2 and 6 percent by weight, Samples H and I, there is no increase in FAQ wet bulk; $WI_{(CDM-L)}$ decreased relative to the control pulp and the pulp sample with only sodium hypophosphite, Samples A and B, respectively.

When pulp is treated with citric acid, sodium hypophosphite and xylitol, a polyol, at the 2 and 6 percent by weight level of xylitol on pulp, Samples F and G, respectively, FAQ wet bulk is 18.18 and 16.83 cc/g, respectively but at the 2 percent by weight addition level, is not different from only treating the pulp with citric acid and sodium hypophosphite, Sample C which has a FAQ wet bulk of 18.48. The$WI_{(CDM-L)}$, of Samples F and G, also increased to 78.50 and 82.10, respectively. At the 6 percent addition level of xylitol, there is actually a reduction in FAQ wet bulk to 16.83 cc/g. However, when pulp is treated only with sodium hypophosphite and two different levels of xylitol, 2 and 6 percent by weight, Samples J and K, both FAQ wet bulk and $WI_{(CDM-L)}$, decreased

relative to the control pulp and the pulp treated with only sodium hypophosphite, Samples A and B, respectively.

It is clear therefore that, contrary to the statements of Hansen et al., polyols do not crosslink with cellulose under the conditions of the instant invention.

In the instant invention, the fibers are cured at a temperature from about 160°C to about 215°C and the individualized intrafiber crosslinked cellulosic fibers have a Whiteness Index greater than about 69.0. In the instant invention, ester crosslink bonds are formed with the polycarboxylic acid and the cellulose, see page 2, line 20 – 28.

Because the Hansen et al. reference teaches binding of particles by hydrogen bonding and coordinate covalent bonding and discourages the formation of covalent bonds in the binding process, there is no motivation to arrive at the instant invention. Also, Applicants have shown that, contrary to Hansen et al. representative polyols as claimed in the invention, do not crosslink with cellulose. Furthermore, the reference teaches away from the instant invention by stating that bonding occurs at low temperatures, that is, at less than 145°C. In contrast, the instant invention teaches crosslinking to form intrafiber bonds at curing temperatures of about 160 °C to about 215 °C to form individualized intrafiber crosslinked cellulosic fibers. Also, the Hansen et al. reference does not show a Whiteness Index greater than about 69. Withdrawal of the rejection is respectfully requested.

<u>The Rejection of Claims 1, and 5-11, Under 35 U.S.C. § 103 (a)</u>

Claims 1 and 5-11 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Hansen et al (US 5,589,256) as applied to Claims 1-4, 12 and 13 and further in view of Hansen et al ,US 5,789,326, (the '326 patent). Withdrawal of the rejection is respectfully requested for the following reasons.

Claim 1 has been addressed above, Claims 5-11 are dependent on Claim 1.

The Hansen et al. reference (the '326 patent) describes a wet laid web of fibers having hydrogen bonding functionality and the binder molecules having at least one functional group capable of forming a hydrogen bond or coordinate covalent bond with particles and at least one functional group capable of forming a hydrogen bond with the fibers column 3, lines 13-23. The patent also describes high bulk fibers with hydrogen

bonding functionality and similar binder characteristics. The '326 reference is cited to show that sorbitol, as set forth in Claims 6 and 7, is specifically identified as a polyol not disclosed in the '256 patent and since it is a polyol also embraces the polyols cited in the instant invention.

As discussed earlier and shown conclusively in the Stoyanov Declaration, polyols such as sorbitol and xylitol do not crosslink with cellulose fibers when tested under conditions in the instant invention. In view of this fact, one of ordinary skill in the art would not be motivated to employ the prior art method with the expectation of obtaining the product.

Applicant submit that there is no motivation, teaching or suggestion to combine the '256 and '326 patents to arrive at the claimed invention. The '256 patent, the '326 patent teach away from covalent ester bonding that is, binding occurs in the two Hansen et al. patents by coordinate covalent bonding or hydrogen bonding as opposed to intrafiber crosslinking by ester bonds in the instant invention. Furthermore, Applicants have shown that polyols such as sorbitol and xylitol do not crosslink with cellulose under the conditions of the instant invention. Other polyols cited in the instant claims embrace sorbitol and xylitol as starting materials in the instantly claimed method since all the alcohols recited in the instant claims as starting materials are polyols. Withdrawal of the rejection is respectfully requested.

CONCLUSION

Based on the foregoing, Applicants submit that the application is in condition for allowance and request that it proceed accordingly. If the Examiner has any further questions or comments the Examiner is invited to contact the Applicants' agent.

Respectfully submitted

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